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wwPDB X-ray Structure Validation Summary Report (i)

May 22, 2023 – 06:05 PM EDT

PDB ID	:	3PGM
Title	:	THE STRUCTURE OF YEAST PHOSPHOGLYCERATE MUTASE AT 0.28 NM RESOLUTION
Authors	:	Campbell, J.W.; Hodgson, G.I.; Warwicker, J.; Winn, S.I.; Watson, H.C.
Deposited on	:	1982-04-06
Resolution	:	2.80 Å(reported)

The following versions of software and data (see references (i)) were used in the production of this report:

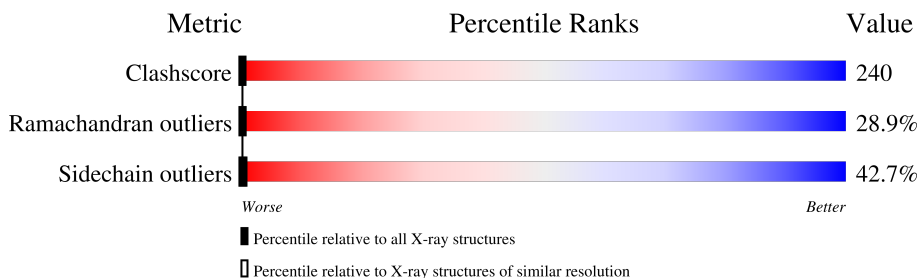|		
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	NOT EXECUTED
EDS	:	NOT EXECUTED
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.33

1 Overall quality at a glance ⓘ

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

The reported resolution of this entry is 2.80 Å.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.

Metric	Percentile Ranks	Value
Clashscore		240
Ramachandran outliers		28.9%
Sidechain outliers		42.7%

Worse   *Better*

■ Percentile relative to all X-ray structures
▯ Percentile relative to X-ray structures of similar resolution

Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
Clashscore	141614	3569 (2.80-2.80)
Ramachandran outliers	138981	3498 (2.80-2.80)
Sidechain outliers	138945	3500 (2.80-2.80)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments of the lower bar indicate the fraction of residues that contain outliers for >=3, 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions <=5%

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	244	5% 36% 39% 14% 6%
1	B	244	6% 36% 39% 14% 6%

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
2	SO4	A	246	-	-	X	-
2	SO4	B	246	-	-	X	-
3	3PG	A	247	-	-	X	-
3	3PG	B	247	-	-	X	-

2 Entry composition ⓘ

There are 3 unique types of molecules in this entry. The entry contains 3708 atoms, of which 0 are hydrogens and 0 are deuteriums.

In the tables below, the ZeroOcc column contains the number of atoms modelled with zero occupancy, the AltConf column contains the number of residues with at least one atom in alternate conformation and the Trace column contains the number of residues modelled with at most 2 atoms.

- Molecule 1 is a protein called Phosphoglycerate mutase 1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	230	Total	C	N	O	S	0	0	0
			1833	1171	319	342	1			
1	B	230	Total	C	N	O	S	0	0	0
			1833	1171	319	342	1			

There are 26 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	46	GLY	LYS	conflict	UNP P00950
A	48	ASN	TYR	conflict	UNP P00950
A	49	VAL	PRO	conflict	UNP P00950
A	50	LEU	ASP	conflict	UNP P00950
A	52	ASP	LEU	conflict	UNP P00950
A	99	GLN	GLU	conflict	UNP P00950
A	?	-	ASP	deletion	UNP P00950
A	?	-	LEU	deletion	UNP P00950
A	170	VAL	SER	conflict	UNP P00950
A	174	SER	VAL	conflict	UNP P00950
A	205	PRO	THR	conflict	UNP P00950
A	207	THR	ILE	conflict	UNP P00950
A	208	ILE	PRO	conflict	UNP P00950
B	46	GLY	LYS	conflict	UNP P00950
B	48	ASN	TYR	conflict	UNP P00950
B	49	VAL	PRO	conflict	UNP P00950
B	50	LEU	ASP	conflict	UNP P00950
B	52	ASP	LEU	conflict	UNP P00950
B	99	GLN	GLU	conflict	UNP P00950
B	?	-	ASP	deletion	UNP P00950
B	?	-	LEU	deletion	UNP P00950
B	170	VAL	SER	conflict	UNP P00950
B	174	SER	VAL	conflict	UNP P00950
B	205	PRO	THR	conflict	UNP P00950
B	207	THR	ILE	conflict	UNP P00950

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Chain	Residue	Modelled	Actual	Comment	Reference
B	208	ILE	PRO	conflict	UNP P00950

- Molecule 2 is SULFATE ION (three-letter code: SO4) (formula: O_4S).

Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	A	1	Total 5	O 4	S 1	0	0
2	A	1	Total 5	O 4	S 1	0	0
2	B	1	Total 5	O 4	S 1	0	0
2	B	1	Total 5	O 4	S 1	0	0

- Molecule 3 is 3-PHOSPHOGLYCERIC ACID (three-letter code: 3PG) (formula: $C_3H_7O_7P$).

3PG

O1

O

O4P

OH

C3   C2(R)   C1   OH O2

P

O2P O = P — O

O1P

OH

O3

OH

O3P
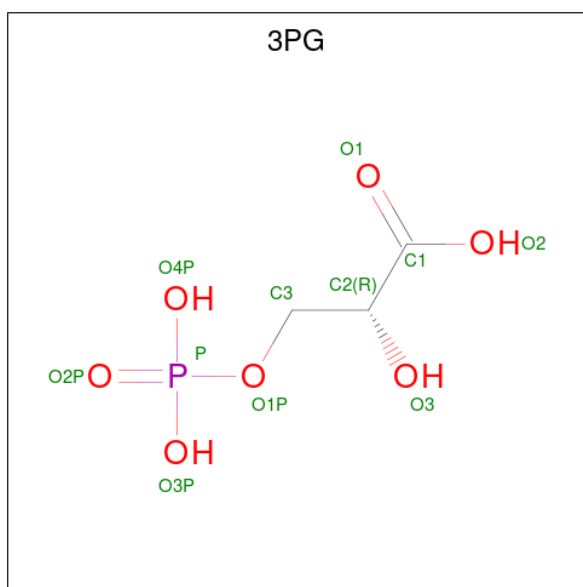
| Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
3	A	1	Total 11	C 3	O 7	P 1	0	0
3	B	1	Total 11	C 3	O 7	P 1	0	0

3 Residue-property plots ⓘ

These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry. Residues are color-coded according to the number of geometric quality criteria for which they contain at least one outlier: green = 0, yellow = 1, orange = 2 and red = 3 or more. Stretches of 2 or more consecutive residues without any outlier are shown as a green connector. Residues present in the sample, but not in the model, are shown in grey.

Note EDS was not executed.

• Molecule 1: Phosphoglycerate mutase 1
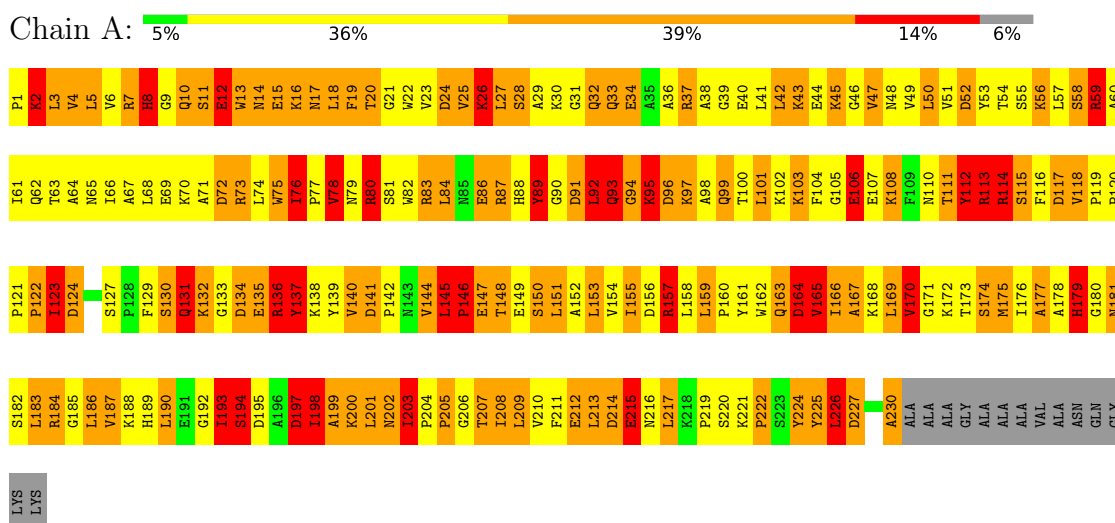
• Molecule 1: Phosphoglycerate mutase 1
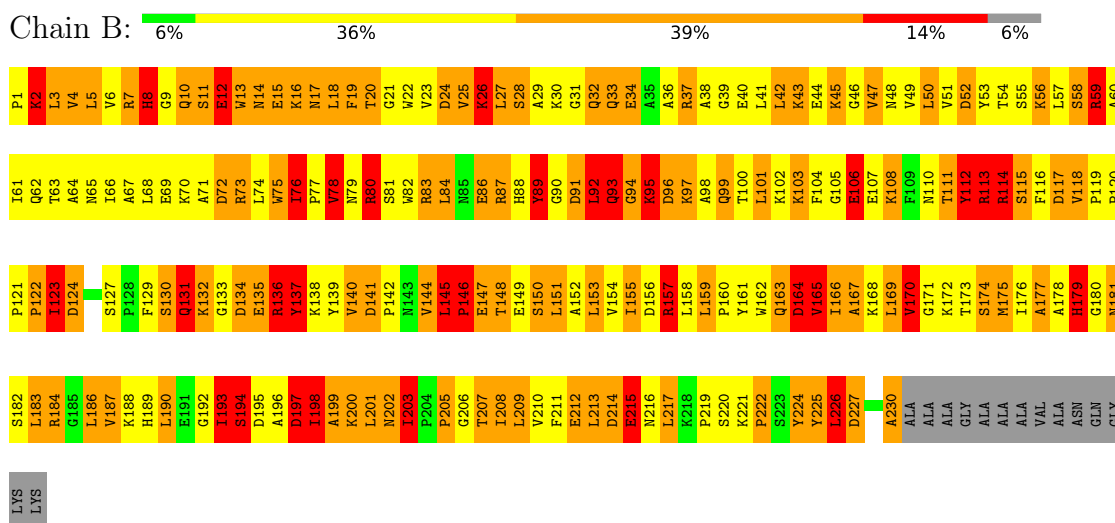
4 Data and refinement statistics ⓘ

Xtriage (Phenix) and EDS were not executed - this section is therefore incomplete.

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α, β, γ	96.40Å　　85.90Å　　81.90Å 90.00°　　120.60°　　90.00°	Depositor
Resolution (Å)	(Not available)　–　2.80	Depositor
% Data completeness (in resolution range)	(Not available) ((Not available)-2.80)	Depositor
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
Refinement program	unknown	Depositor
R, R_{free}	(Not available)　,　(Not available)	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	3708	wwPDB-VP
Average B, all atoms (Å^2)	0.0	wwPDB-VP

5 Model quality (i)

5.1 Standard geometry (i)

Bond lengths and bond angles in the following residue types are not validated in this section: 3PG, SO4

The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 5$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	#$|Z|$ >5	RMSZ	#$|Z|$ >5
1	A	0.99	2/1875 (0.1%)	1.36	17/2541 (0.7%)
1	B	0.99	2/1875 (0.1%)	1.36	17/2541 (0.7%)
All	All	0.99	4/3750 (0.1%)	1.36	34/5082 (0.7%)

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	2	LYS	CA-CB	7.07	1.69	1.53
1	B	2	LYS	CA-CB	7.07	1.69	1.53
1	A	230	ALA	CA-C	5.28	1.66	1.52
1	B	230	ALA	CA-C	5.28	1.66	1.52

The worst 5 of 34 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	137	TYR	CB-CG-CD2	-8.07	116.16	121.00
1	B	137	TYR	CB-CG-CD2	-8.07	116.16	121.00
1	A	184	ARG	NE-CZ-NH2	7.46	124.03	120.30
1	B	184	ARG	NE-CZ-NH2	7.46	124.03	120.30
1	A	59	ARG	NE-CZ-NH2	7.43	124.01	120.30

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts (i)

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within

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the asymmetric unit, whereas Symm-Clashes lists symmetry-related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	1833	0	1849	909	13
1	B	1833	0	1849	909	13
2	A	10	0	0	5	0
2	B	10	0	0	6	0
3	A	11	0	4	20	0
3	B	11	0	4	19	0
All	All	3708	0	3706	1777	14

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). The all-atom clashscore for this structure is 240.

The worst 5 of 1777 close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:51:VAL:CG2	1:A:174:SER:HB2	1.26	1.60
1:B:51:VAL:CG2	1:B:174:SER:HB2	1.26	1.60
1:A:14:ASN:HB2	1:A:20:THR:CB	1.32	1.54
1:A:5:LEU:CD1	1:A:183:LEU:HD12	1.29	1.53
1:B:14:ASN:HB2	1:B:20:THR:CB	1.32	1.52

The worst 5 of 14 symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:16:LYS:O	1:B:16:LYS:O[4_444]	0.65	1.55
1:A:17:ASN:CB	1:B:17:ASN:CB[4_444]	1.21	0.99
1:A:18:LEU:CD1	1:B:16:LYS:CD[4_444]	1.57	0.63
1:A:97:LYS:O	1:B:16:LYS:NZ[4_444]	1.64	0.56
1:A:17:ASN:CB	1:B:17:ASN:CA[4_444]	1.65	0.55

5.3 Torsion angles ⓘ

5.3.1 Protein backbone ⓘ

In the following table, the Percentiles column shows the percent Ramachandran outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the backbone conformation was

analysed, and the total number of residues.

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	A	228/244 (93%)	111 (49%)	51 (22%)	66 (29%)	0	0
1	B	228/244 (93%)	111 (49%)	51 (22%)	66 (29%)	0	0
All	All	456/488 (93%)	222 (49%)	102 (22%)	132 (29%)	0	0

5 of 132 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	8	HIS
1	A	12	GLU
1	A	15	GLU
1	A	16	LYS
1	A	19	PHE

5.3.2 Protein sidechains ⓘ

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the sidechain conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	199/204 (98%)	114 (57%)	85 (43%)	0	0
1	B	199/204 (98%)	114 (57%)	85 (43%)	0	0
All	All	398/408 (98%)	228 (57%)	170 (43%)	0	0

5 of 170 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	93	GLN
1	B	165	VAL
1	B	101	LEU
1	B	131	GLN
1	B	183	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 13 such sidechains are listed below:

Mol	Chain	Res	Type
1	B	65	ASN
1	B	99	GLN
1	B	179	HIS
1	B	131	GLN
1	B	163	GLN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains ⓘ

There are no non-standard protein/DNA/RNA residues in this entry.

5.5 Carbohydrates ⓘ

There are no monosaccharides in this entry.

5.6 Ligand geometry ⓘ

6 ligands are modelled in this entry.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\#|Z| > 2$	Counts	RMSZ	$\#|Z| > 2$
2	SO4	B	245	-	4,4,4	0.21	0	6,6,6	0.11	0
3	3PG	A	247	-	9,10,10	1.17	1 (11%)	12,14,14	1.32	1 (8%)
3	3PG	B	247	-	9,10,10	1.17	1 (11%)	12,14,14	1.32	1 (8%)
2	SO4	A	245	-	4,4,4	0.21	0	6,6,6	0.11	0
2	SO4	B	246	-	4,4,4	0.17	0	6,6,6	0.14	0
2	SO4	A	246	-	4,4,4	0.17	0	6,6,6	0.14	0

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the

Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	3PG	B	247	-	-	3/10/10/10	-
3	3PG	A	247	-	-	3/10/10/10	-

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	247	3PG	O1-C1	2.39	1.29	1.22
3	B	247	3PG	O1-C1	2.39	1.29	1.22

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
3	A	247	3PG	O2-C1-C2	3.19	119.72	112.72
3	B	247	3PG	O2-C1-C2	3.19	119.72	112.72

There are no chirality outliers.

5 of 6 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	247	3PG	C1-C2-C3-O1P
3	A	247	3PG	O3-C2-C3-O1P
3	B	247	3PG	C1-C2-C3-O1P
3	B	247	3PG	O3-C2-C3-O1P
3	A	247	3PG	C2-C3-O1P-P

There are no ring outliers.

6 monomers are involved in 50 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	B	245	SO4	1	0
3	A	247	3PG	20	0
3	B	247	3PG	19	0
2	A	245	SO4	1	0
2	B	246	SO4	5	0
2	A	246	SO4	4	0

5.7 Other polymers ⓘ

There are no such residues in this entry.

5.8 Polymer linkage issues ⓘ

There are no chain breaks in this entry.

6 Fit of model and data ⓘ

6.1 Protein, DNA and RNA chains ⓘ

EDS was not executed - this section is therefore empty.

6.2 Non-standard residues in protein, DNA, RNA chains ⓘ

EDS was not executed - this section is therefore empty.

6.3 Carbohydrates ⓘ

EDS was not executed - this section is therefore empty.

6.4 Ligands ⓘ

EDS was not executed - this section is therefore empty.

6.5 Other polymers ⓘ

EDS was not executed - this section is therefore empty.